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Management of full-thickness skin grafts

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ABSTRACT

Full-thickness skin grafts are a commonly used reconstructive method following Mohs micrographic surgery. The literature varies on the most appropriate methods of suturing and securing grafts as well as best practices to dress the graft postoperatively. Our objective was to review various approaches to management of full-thickness skin grafts, including suturing the graft, securing the graft, and topical emollient use on the graft postoperatively. It was found that absorbable sutures, plain gut, provide preferable outcomes with full-thickness skin grafts. The tie-over bolster is the most-used method for securing skin grafts after placement, although several other methods have demonstrated efficacy, including the polyurethane foam, sandwich, and quilting suture methods. While various topical emollients are used in the immediate postoperative period, plain white petrolatum is the least likely to form allergic contact dermatitis.

KEYWORDS Full-thickness skin graft; Mohs micrographic surgery; suture; topical emollient

Skin grafts, particularly full-thickness skin grafts (FTSG), are commonly used in cutaneous reconstruction following Mohs micrographic surgery. These grafts rely on imbibition, inosculation, and neovascularization within the recipient bed to survive.[1–5] In an effort to reduce the frequency of graft complications (e.g., infection, necrosis, contracture) and to optimize esthetic outcomes, several methods of graft management have been developed.[6–13] Unfortunately, there is a lack of consensus and consistency in the management of the FTSG. This literature review assessed various approaches in the management of FTSG, including suturing, securement, and the use of topical emollients.

LITERATURE SEARCH METHODS

A PubMed search using the keywords *full-thickness skin grafting, Mohs surgery, emollient, tie-over bolster,* and *suture* was performed for published literature in English. Additional keywords included *dressing, management,* and *white petroleum*. Results from this search pertaining to sutures, graft dressings, and topical emollients were included in this literature review. A total of 23 articles were found addressing these topics in the context of FTSG or Mohs micrographic surgery.

SUTURING THE GRAFT

Although a consensus has not been reached among Mohs surgeons on the type of suture most suitable for securing the FTSG, the literature suggests that absorbable sutures, particularly plain gut, are preferred, as the removal step becomes unnecessary and comparable outcomes are achieved.[14–17] Fast-absorbing plain gut sutures provide a stable method of securing the graft without bunching and with minimal skin reaction.[14,18] Additionally, topical skin adhesives, such as N-butyl-2 cyanoacrylate, have shown comparable outcomes to conventional suturing while requiring less time in application.[19]

SECURING THE GRAFT

Several methods of securing FTSG have been discussed in the literature. Most methods involve the use of a suture *(Figure 1a)* or staples to fasten various materials on top of the graft, thus protecting and securing the graft. Examples of materials used include gauze, sponges, buttons, and even sections of tongue depressors *(Figure 1b, 1c)*.

Tie-over bolster dressing

The classic and arguably most popular method of securing the FTSG involves the tie-over bolster dressing.[16,20] This dressing method uses various dressings or "stents" that are

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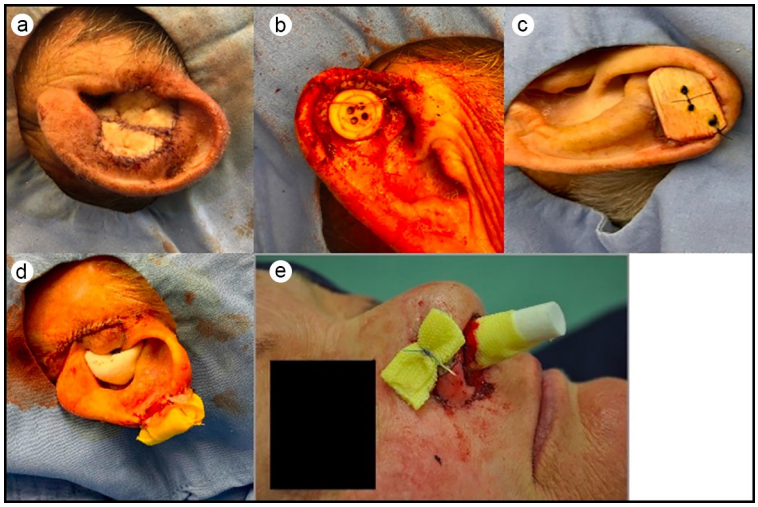

Figure 1. Methods to secure full-thickness skin grafts: **(a)** running plain gut suture, **(b)** button bolster, **(c)** tongue depressor bolster, **(d)** Xeroform tie-over bolster, **(e)** sandwich suture.

sutured over the graft to ensure that the graft remains in contact with the underlying recipient bed and to support inosculation *(Figure 1d)*.[6] The pressure applied by the bolster prevents mobilization and shearing forces and decreases the risk of infection, hematoma, and desiccation.[21,22] Since it is one of the most widely used methods of securing the FTSG, the tie-over bolster has often been tested against alternative methods.[20,22–26] These techniques have been developed in an effort to avoid the potential disadvantages of the tie-over bolster (e.g., bulkiness, impairment of normal blood flow, and impairment of wound inspection).[22,25,27]

Running bolster suture

An alternative method of securing the bolster dressing is the running bolster suture. This technique uses one continuous length of suture and one knot to secure the bolster material.[1] With that approach, the likelihood of uneven suture loading is decreased and the risk of suture breakage or potential skin pull-through is minimized.[1] The primary disadvantage of this method comes from using one suture and knot. If either becomes disrupted, the entire bolster can fail.[1]

Stapled telfa bolster

Hoffman et al documented the use of stapled Telfa bolsters to secure skin grafts.[28] After securing the periphery of the graft in the conventional manner, antibiotic ointment and one layer of nonadherent petrolatum gauze are placed over the graft. Next, three to four layers of Telfa are placed over the defect and stapled circumferentially around the graft.[29] This creates an airtight seal and avoids bulky bolster dressings.[28]

Sponge bolster

Egan et al advocated for use of a sponge bolster over the commonly used tie-over bolster.[30] In this method, the sponge from a standard disposable scrub brush is removed and cut to the shape of the graft with a 3 mm to 4 mm graft overlap.[30] Next, the sponge is secured over a nonadherent dressing by an adhesive dressing such as Mefix.[30]

Polyurethane foam technique

The polyurethane foam technique uses layers of gas-sterilized foam secured with 4-0 or 5-0 sutures around the periphery of the foam.[31] The amount of pressure on the graft is determined by the number of sheets of foam layered on top of the graft. In 26 patients who underwent FTSG with this technique, the graft survival rate was 88.9%; Nakamura et al stated that this technique is a simple and effective method that increases graft survival compared to traditional tie-over bolsters.[32]

Sandwich suture

For FTSG placed in locations such as the nasal ala or ear, the "sandwich suture" *(Figure 1e)* proposed by Hussain and colleagues may be best suited.[33] In this method, the FTSG is secured to the recipient site by an overlying bolster on one side and a paraffin-impregnated gauze plug on the other side of the tissue. This creates a "sandwich" of the graft and recipient bed between the bolster and gauze plug.[16] In a retrospective analysis of 181 patients, it was found that those who received FTSG with the sandwich suture technique had good functional and cosmetic outcomes with few postoperative complications.[34]

The racket graft

In 2013, Vargas-Diez et al shared their inventive technique, the "racket graft." This method utilizes a smaller version of FTSG and decreases tension from securing sutures.[35] After a cutaneous lesion is removed, hooks or temporary sutures are used to pull on the boundaries of the defect and measure the maximal advancement of tissue.[35] Next, a comparatively smaller graft is harvested from a usual donor site. Finally, two to four sutures are placed across and through the graft in a design resembling a tennis racket, thus securing the graft to the boundaries of the defect.[35] Placing the racket sutures in this fashion prevents tension from being transmitted to the graft itself.[35]

Unsuture technique

Mention should be made of the "unsuture" technique for securing a bolster. Orengo et al described a method of securing a bolster over a skin graft with half-inch Steri-Strips rather than sutures as in the tie-over technique. The proposed benefits of this method include protecting the graft without tenting wound edges, leaving less tension on the wound, and avoiding suture marks.[14,32]

Basting sutures

"Quilting" is an alternative method for securing grafts.[36–38] In this method, the graft is first secured to the recipient bed with continuous absorbable sutures. Next, two or three quilting/basting absorbable sutures are placed along the midline of the graft.[16] In 2018, Kromka et al reviewed the literature comparing the use of tie-over bolster dressings and quilting using basting sutures and concluded that graft take, cosmetic outcomes, and postoperative complications were comparable between the two methods.[16]

Dressing removal and wound care

Typically, if material is used to bolster the graft, the material is removed 5 to 7 days postoperatively.[14,23,32] The literature suggests that blood and lymphatic circulation have been fully restored to the graft within 7 days.[1,5,39] After removal of the bolster, the dermatologist may instruct the patient that no further wound care is needed.[32] However, as grafts are temperamental for several days after bolster removal, our patients are advised to clean the wound gently. We also instruct our patients to apply white petroleum jelly to keep the wound moist. Lastly, our patients are advised to keep the wound covered for an additional week and to avoid sun exposure for several months.

TOPICAL EMOLLIENTS

The results of a survey completed by 294 Mohs surgeons in 2013 suggested that the topical emollient most commonly used after securing a FTSG was petroleum jelly (53.11%), followed by Aquaphor (19.4%) and Bacitracin (8.2%).[40] In that same survey, the surgeons were asked about recommendations they gave to patients for home management of the graft. Surgeons recommended the use of petroleum jelly (69.4%), Aquaphor (38.4%), bacitracin (10.0%), mupirocin (9.2%), polymyxin (8.8%), neomycin (2.0%), and gentamicin (1.0%).[40] These findings differ from the study in 2010, in which Park et al reported that the most commonly used postoperative ointment was Aquaphor Healing Ointment (60%), followed by petrolatum (34%).[41] Further, many surgeons recommended against use of neomycin (92.8%), polymyxin (44.3%), and bacitracin (44.3%).[40]

The relatively low use of topical antibiotics after surgery is likely due to the allergenic potential in these products,[42,43] with triple antibiotic ointment and bacitracin commonly listed among the most common allergic contact allergens. Similarly, the higher prevalence of white petroleum use over Aquaphor may stem from the potential allergic contact dermatitis to Aquaphor, likely due to lanolin.[44] In a study evaluating wound reactivity postoperatively, it was found that use of Aquaphor Healing Ointment had a higher incidence of wound redness (52%) than plain white petrolatum (12%).[45]

DISCUSSION

While the FTSG is commonly used to repair defects in Mohs micrographic surgery, optimal management of the graft has not been elucidated due to the lack of high-quality evidence in the literature. Few comparative studies or randomized controlled trials have been conducted to determine the best sutures, dressings, and emollients to use to secure the graft and produce the best esthetic outcome. The literature suggests that absorbable sutures, plain gut, may be preferable as they produce clinical outcomes similar to nonabsorbable sutures without the potential disruption of the neovascular network and need for painful suture removal. When it comes to securing the graft, the tie-over bolster is the most widely used method. However, many alternative methods have been published in the literature. In particular, the polyurethane foam and the "quilting" method using basting sutures have been studied in direct comparison to the tie-over bolster and have shown comparable results. In addition, the "sandwich" suture method and use of the tissue adhesive N-butyl-2 cyanoacrylate have been studied and found to produce favorable results with minimal complications. Lastly, various topical emollients have been used on FTSG, with plain white petroleum being the most used and the least reactive.

The main limitations of this study include the sparsity of comparative studies or clinical trials. We suggest that additional comparison studies be conducted, e.g., comparing the use of ointment under dressings with not using ointment. These, in addition to comparison studies investigating sutures and dressings, would undoubtedly be beneficial in determining the ideal management of FTSG.

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